1.0 INTRODUCTION

Congress directed the U.S. Army Corps of Engineers (USACE) to evaluate the potential impact of perchlorate releases associated with the former Naval Weapons Industrial Reserve Plant in McGregor, Texas (NWIRP McGregor). Congress was concerned that the NWIRP McGregor plant may have impacted water quality and/or the environment in the adjacent Bosque River and Leon River watersheds. These watersheds flow into Lake Belton and Lake Waco, two important regional sources of drinking water. The USACE assembled a multi-disciplinary project team to study and report on this issue. This report presents the results of the team's study.

1.1 STUDY HISTORY AND BACKGROUND

The primary source of perchlorate contamination within the Bosque and Leon River watersheds is believed to be a result of former activities at NWIRP McGregor. A brief historical summary of this facility is presented in Section 1.1.1. The goals and activities of the USACE and its project team in evaluating perchlorate releases to the Bosque and Leon River watersheds are described in Section 1.1.2.

1.1.1 NWIRP McGregor History

In 1942, the U.S. Army Ordnance Corps established the Bluebonnet Ordnance Plant on 18,000 acres of land in McGregor, Texas. During this tenure, it included facilities run by National Gypsum of Buffalo, New York, to load explosives into bomb bodies during World War II. Production at this facility ceased at the conclusion of the war and the War Department formally closed the facility in 1946.

After World War II, changes in ownership of the property occurred often and included sales to private parties and to Texas A&M University. In 1952, the U.S. Air Force acquired 11,450 acres of the original 18,000 acres and named the area U.S. Air Force Plant 66. Phillips Petroleum Company oversaw the production of jet-assisted take-off boosters during this time period, until the U.S. Air Force expropriated the property to the U.S. Navy in 1966.

After the transfer from the U.S. Air Force, the U.S. Navy renamed the property the Naval Weapons Industrial Reserve Plant, McGregor, Texas. In 1972, 70 acres were transferred to the McGregor School District, 33 acres surrounding the wastewater treatment plant were transferred to the City of McGregor, and 1,600 acres were sold to private parties. Currently, several thousand acres are leased for agriculture. From 1978 to 1995, the Hercules Corporation produced solid propellant rocket motors at NWIRP McGregor for a variety of missiles. Production of these weapons ceased in 1995, when Hercules Corporation was purchased by Alliant Techsystems, Inc.

In 1998, The City of Waco collected 10 samples from selected surface water locations outside the NWIRP McGregor facility that indicated the presence of perchlorate,

presumably related to activities at the former plant. This presumption resulted from the fact that a major component of the solid propellant of missiles and rockets manufactured at NWIRP McGregor was ammonium perchlorate. Throughout the remainder of this document "perchlorate" will be used to indicate the perchlorate ion, (ClO_4^-).

In 1999, the U.S. Navy collected additional samples from monitoring wells, springs, and Lake Belton. The U.S. Navy detected perchlorate at a total of 19 sites with concentrations in these samples ranging from approximately 2 to 3,300 parts per billion (ppb) (EnSafe, 1999a). The U.S. Navy also detected perchlorate in an isolated sample from Lake Waco in 2000. However, this detection is thought to be an anomaly that cannot be reproduced and does not appear to be representative of conditions in the lake (EnSafe, 1999a).

Investigation and remediation activities are ongoing at the site. As cleanup of NWIRP McGregor proceeds, the U.S. Navy is transferring portions of the property deemed safe for commercial/industrial redevelopment to the City of McGregor by Congressional order. As of September 2003, the U.S. Navy had transferred approximately 6,000 acres to the City of McGregor.

Historical use and summaries of the situation at former NWIRP McGregor are also included in the *Perchlorate Monitoring Plan* (Montgomery Watson, 1999) and *Community Relations Plan* (USACE, 2001a). A complete history of various investigation and remediation activities that have occurred at the former NWIRP McGregor plant is presented in detail in the *Draft-Final Groundwater Investigation Phase III Report* (EnSafe, 2003).

1.1.2 Study Overview

The USACE assembled an integrated, multi-disciplinary project team consisting of the USACE, Brazos River Authority (BRA), The Institute of Environmental and Human Health at Texas Tech University (TIEHH), Montgomery Watson Harza (MWH), the U.S. Environmental Protection Agency (USEPA), the Texas Commission on Environmental Quality (TCEQ), the City of Waco, and the City of Killeen. The primary goal of the USACE and the project team was to evaluate potential human and environmental exposures to perchlorate in the Lake Waco and Lake Belton study area. To meet this goal, the USACE performed a number of investigations, including watershed characterization and analysis to determine how perchlorate migrates through the environment and biological characterization to evaluate potential exposure to humans and the environment. This final report presents the results from all of these investigations.

1.2 STUDY GOAL & OBJECTIVES

1.2.1 Goal

The overall goal of the project team was to evaluate potential human and environmental exposure to perchlorate in the Lake Waco and Lake Belton study area. Perchlorate, because of its high mobility and persistence in the environment, has the potential to migrate far from its source, primarily via water, and to impact not only ecological

systems but also to pose a threat to local drinking water supplies. In the Lake Waco and Lake Belton study area, recognition of this threat resulted from the detection of perchlorate in soils, surface water, and groundwater within the boundaries of NWIRP and the documented migration of this perchlorate via its detection in off site streams, springs, and dug wells (EnSafe, 1999a). This study was not intended to assess certain sites and properties, and findings from this study should not be used for that purpose.

To achieve the study goal, the project team identified and evaluated all of the existing, relevant data, analyzed these data relative to the study objectives, and identified and prioritized the resulting data gaps. This initial phase of the study was documented in the *Final Conceptual Site Model* (MWH, 2002a). The project team then developed and implemented a comprehensive, 12-month field data collection program to fill the most critical data gaps. The team initiated parts of the field data collection program relating to some of the more obvious ecological data gaps prior to completing the conceptual site model. The field data collection efforts for these portions of the study lasted as long as 21 months. The results of this effort are documented in this report, which incorporates available information on sources of perchlorate contamination and release, the surface hydrology and hydrogeological characteristics of the Bosque and Leon River watersheds, the nature of perchlorate fate and transport, potential pathways of perchlorate migration within the study area, and the human receptors and environmental resources that may be exposed to perchlorate.

1.2.2 Objectives

The project team held an initial Technical Project Planning (TPP) Meeting on February 6-7, 2001. At the TPP meeting, existing study area information was discussed, the project scope was defined, and project objectives were outlined. The project objectives are summarized below.

- Develop an effective community relations plan
- Compile existing study area information
- Identify data gaps in existing information
- Define and develop the Conceptual Site Model (CSM)
- Develop Field Sampling Plans based on data gaps
- Implement the Field Investigation to fill the key data gaps
- Evaluate fate and transport pathways
- Evaluate potential environmental exposure to perchlorate in the study area
- Evaluate potential human exposure to perchlorate in the study area
- Assess exposure pathways to vegetation, fish, birds, and mammals
- Assess impact on amphibians, fish, and large and small mammals

A complete set of project documents may be viewed and downloaded at the following web-site: http://www.swf.usace.army.mil/ppmd/Perchlorate/index.html. These documents

include project plans, a bibliography of historical information, the *Final Conceptual Site Model* (MWH, 2002a), team meeting minutes, public meeting minutes, slide presentations, and project generated data.

1.3 REPORT ORGANIZATION

The information presented in the Final Report is organized as follows:

Section 1.0 Introduction. Describes the purpose and scope of the Final Report, and summarizes its organization

Section 2.0 Environmental Setting. Provides a summary of the physical characteristics of the study area.

Section 3.0 Investigation History. Summarizes previous and current investigations of former NWIRP McGregor and the Bosque and Leon River watersheds.

Section 4.0 Study Descriptions. Summarizes the various watershed, ecological, plant and animal investigations conducted as part of this study.

Section 5.0 Data. Presents the various water, sediment, plants and animal data collected as part of this study.

Section 6.0 Updated Hydrologic Conceptual Site Model. Updates the hydrologic conceptual site model originally presented in the *Final Conceptual Site Model* (MWH, 2002a) based on new information gathered.

Section 7.0 Exposure Assessment. Identifies the human receptors and ecological resources within the study area, and describes potential pathways of exposure to perchlorate.

Section 8.0 Conclusions. Summarizes major conclusions of this report.

Section 9.0 References. Lists the sources cited in this report.